DOCUMENT RESUME

ED 409 004 IR 018 419

AUTHOR	Agalianos, Angelos S.
TITLE	Towards a Sociology of Educational Computing.
PUB DATE	Apr 96
NOTE	32p.; Paper presented at the Annual Meeting of the American Educational Research Association (New York, NY, April 8-12, 1996).
PUB TYPE	Reports - Evaluative (142) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Case Studies; Comparative Education; Computer Science Education; *Computer Uses in Education; Educational Change; Educational Technology; Elementary Secondary Education; Foreign Countries; *Political Influences; Politics; *Programming Languages; *Social Influences; Sociology; Use Studies
IDENTIFIERS	Barriers to Innovation; *LOGO Programming Language; United Kingdom; United States

ABSTRACT

The development of educational computing in the last two decades has been largely uncritical and the field is dominated by technocentric approaches. With few notable exceptions, sociologists of education have not directly addressed educational computing. As a result, the social, political and cultural origins and implications of educational computing have remained to date underexplored. Viewing education as a predominantly social and political phenomenon, this paper suggests that information technology in education should be situated within its neglected social context. It draws on research which appropriates ideas from the sociology of education, sociology of technology, social theory and cultural studies, and looks into the development and evolution of Logo programming language in education in United States and British primary and secondary schools as a case study in the politics of educational change. The predominant lesson drawn from this analysis is that when Logo was introduced, preexisting social relations were largely able to utilize the new technology as an avenue for reasserting themselves, thus reinforcing the status quo. In both United States and United Kingdom primary schools, Logo ended up being seen most often as an elementary geometrical program, or simply as an exercise in enjoyable computer interaction. In secondary schools, if Logo was used at all, it was used in the context of "teaching programming" rather than as a means of expressing mathematical ideas. The dominant and powerfully established school structures changed the meaning of Logo and assimilated it into the existing system, to the disappointment of its original developers. (Contains 42 references.) (Author/AEF)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Towards a Sociology of Educational Computing[1]

Angelos S. Agalianos
Institute of Education, University of London, UK[2]

AERA Annual Meeting, April 1996

ED 409 004

Abstract. *The development of educational computing in the last two decades has been largely uncritical and the field is dominated by technocentric approaches. With few notable exceptions, sociologists of education have not directly addressed educational computing. As a result, the social, political and cultural origins and implications of educational computing have remained to date underexplored. Viewing education as a predominantly social and political phenomenon, the paper suggests that IT in education should be situated within its neglected social context. It draws on research which appropriates ideas from the sociology of education, sociology of technology, social theory and cultural studies, and looks into the development and evolution of Logo programming language in education as a case-study in the politics of educational change.*

1. Introduction. Education does not take place in a vacuum. Rather, it is a terrain where conflicting ideologies compete and relations of power are inscribed; schooling is deeply social and political having a key role in social and cultural reproduction and transformation. Despite, however, the accumulation of studies illustrating the social and political nature of schooling, sociological work concerned with educational computing is in short supply. It seems that the people who do critical sociology of other aspects of education stay away from technology (perhaps they view technology as inherently anti-democratic and have ceded the field to unthinking technocrats), and the people who do educational technology have little interest in sociology, let alone critical sociology. The critical work done on technology more generally has gained remarkably little attention within educational circles.

Thus the current dominance of technological determinist accounts of the use of technology in education still obscures how technology both affects and reflects the surrounding social conditions. As a result of this...

> ...all too frequently we act on the implicit assumption that technology is a "neutral tool" whose impact depends wholly on the ends to which it is applied, or that it is an implacable external force, autonomously driving the rest of society in one direction or another (Bromley, 1995:introduction).

---

[1] The paper is based on my thesis-in-progress *Towards a Sociology of Educational Computing: the Politics of Logo* (provisional) at the Institute of Education, University of London.

[2] While still working on his thesis for the Institute of Education, the author is now temporarily based in Brussels where he works for the Directorate General XXII of the European Commission (Education, Training and Youth) on EC's policy development on educational software and multimedia.

IR018419

BEST COPY AVAILABLE

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Angelos S. Agalianos
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

I want to suggest here that the technoromantic rhetoric surrounding the introduction and use of IT in education should be opposed in favour of a cautious approach which will highlight the deep entanglement of technologies in education with power as exercised at different levels. According to Bromley (1995), such an understanding requires addressing at least the following specific topics:

- how "educational" technologies are shaped by the context in which they are developed and in turn carry the values prevalent in that context into the sites where the technologies are used (schools); and

- how the power relations of the context where a technology is applied also shape the way it is used.

Yet, the development and use of educational computing during the last fifteen years is rarely discussed in these terms. The literature remains largely technocentric and the field is dominated by the desocialised approaches of computer scientists, cognitive psychologists, industrialists and technical/vocational trainers. With few notable exceptions[3], educational computing has not become the subject of critical sociological enquiry. As a result, the social, political and cultural origins and implications of educational computing have remained to date underexplored. The social processes and the political decisions involved in the production and "consumption" of IT in education are largely ignored. Most often, the typical history of computer technology and programming languages for education narrows the discussion to the chronological development of the technical aspects of hardware and software (e.g. Wexelblat, 1981; Friedman, 1992; Lee, 1991) and to what appears to suggest the seemingly neutral, benign and disinterested acquisition of hardware and software by educators as schools are told they must enter the "information age". This paper draws on a research study which is understood as a contribution to recast this history.

2. An outline of the project. This paper reports briefly findings of research done for the author's PhD thesis at the University of London (still in progress). The research has been an interdisciplinary endeavour appropriating theoretical developments in the sociology of education, social theory, sociology of technology and cultural studies. The first part of the thesis points to the need to interpret schooling and the curriculum as both a system of production and reproduction. Drawing upon critical work in the sociology of education which has stripped schools of the ethical and political innocence attributed to them earlier by functionalist social theorists, this part of the thesis argues that schools should be seen as arenas of power conflicts and ideological domination as well as possibilities. In addition, rejecting notions of computer technology as a neutral, ahistorical and non-social object, it raises questions that strive to situate technological products -and particularly computers in education- within a social paradigm. Thus, this first part of the thesis establishes five main arguments that run through the whole study:

- that most existing accounts of IT in education are inadequate for various reasons;
- that education and schooling are deeply entangled in the social and political;
- that sociology of education and cultural studies can -and should- add to our social perspectives on the use of computers in education;

---

[3] For example, see Beynon & Mackay (1989), Robins & Webster (1989); Noble (1991); Bigum & Green (1992); Muffoletto & Knupfer (1993); Apple (1993), Bromley (1995).

- that technological artefacts used in education are socially constructed and can be analysed in terms of a "circuit of cultural production" (a model developed by Johnson, 1983);
- that we could demonstrate the utility of this model by running it through the development and implementation of a major IT phenomenon, that is Logo.

In the second part of the thesis, Logo programming language is spinned through Johnson's "circuit" as a case-study. It is being suggested there that the development and evolution of Logo programming language and its discourse on education is an interesting example reflecting the social nature of both technology and education. Analysis of research evidence is divided in four parts (four analytically distinct "moments"), following Johnson's circle:

Moment 1: Through reconstructed accounts of participants and secondary sources, analysis of moment 1 (*production*) demonstrates the contingent and unstable nature of Logo as constantly changing and developing technology in the context of the decision-making processes. That account challenges a number of existing accounts that have been referred to earlier in the thesis, e.g. technological determinist and certain neo-Marxist studies. Analysis here provides an account of the social forces and social processes involved in Logo's "production". The early history of Logo is chronicled and discussed showing that - far from consensual- the development of Logo has been an arena of ideological struggle where social, political, commercial and interpersonal conflicts were played out. Using largely the framework of the social shaping of technology, I advance the thesis that the development of Logo was socially constructed. Logo did not evolve chiefly on its technical merits but, rather, it was the product of negotiation under the influence of considerable social, political and economic forces. The lack of agreement on standards, the conflict of interests between the different groups involved, the range of approaches and objectives, are some of the clues supporting the argument that the evolution of Logo was not linear nor even primarily technical. In addition, the problems, solutions and social groups associated with Logo changed during the course of its evolution -they were "redefined". From a social constructivist point of view, various social groups (including research laboratories, funding agencies, military research, hardware and software industry and "progressive" educationalists) lobbied for the system they wanted, all making ideological claims to support what were unconclusive data about the educational value of Logo. The development of Logo was a "seemless web" in which the technical was interwoven with the social, economic and political.

Moment 2: An analysis of Logo *as a "text"* is undertaken here: it is suggested that the Logo-text is constituted by "internal" and "external" aspects. In terms of the "internal" aspects of the Logo discourse (that is the structural design of Logo-the-language) it is argued that the social processes at the level of production have inscribed in Logo-the-language (through the particular choices over its technical design) certain "preferred meanings" which reflect ("encode") the educational "philosophy", the ideological and epistemological assumptions of its developers. It is argued that the material form of Logo-the-language was consciously structured as a symbol, as a collection of signs which mirrored the ideas and expectations of its creators and was- implicitly or explicitly- compatible with and supportive of certain forms of use rather than others. The elaboration of the nature of the "external" aspects of the Logo-text attempts to locate the "Logo discourse[4]" socially and ideologically through a discussion of some of its

[4] By *discourse* I mean language as it is produced, deployed, and used by human actors within an emergent and contested social context to advance particular projects (Foucault, 1977). I also mean language as a cultural and historical production that represents or takes for granted certain beliefs, values and practices,

assumptions and theoretical influences. It is argued there that the "Logo philosophy" is built upon a number of ideological and epistemological assumptions about schooling, education, learning, knowledge, mathematics, culture and society. It is argued that these are ideological positions which emerged as products of particular social processes, within a particular social, political and historical context.

Moment 3: Thirdly, the influence of the social context of use is discussed here and Logo is treated as a case-study in educational innovation at a macro-level. It is suggested that "restructuring" formulates the context against which the backlash against Logo in the 1980s must be seen. It is argued that what the literature describes as the "pendulum swing" against Logo in the 1980s was largely a consequence of the conservative restorational politics in the education and society of both Britain and the US which eroded the basis of child-centred Logo-like approaches to schooling. I illustrate that while Logo was initially intended as a tool for radical educational change which would "revolutionise" educational practice and change our thinking about teaching and learning, in the majority of US classrooms it became subsumed to a technicist effort to appropriate computers in the context of an ideological "computer literacy" campaign which swept the US in the early 1980s. In this sense, the introduction of Logo in US schools has coincided with and reinforced a hegemonic vision of educational reform at a time of conservative restoration in US education.

Moment 4: Against this background lastly, analysis of "moment 4" (*lived cultures*) looks into the process of Logo's recontextualisation and appropriation in real American and British schools and classrooms; what happened when Logo was lifted from the context of MIT and was taken to real schools, is the last major question asked in the thesis. Analysis shows how Logo has related to the organisational culture of schools and how within this culture Logo has become appropriated (in fact largely "normalised", institutionalised and assimilated into existing practices) by social groups and individuals in pursuit of their goals in their day-to-day experience of schooling. Arguably, this discussion provides a window into the ways in which the social context of Logo use and the pre-existing power relations in and around school settings where Logo was introduced tended to utilise the new technology as an avenue for reasserting themselves. As a representative case illustrating the tension between the original expectations of its designers and the ways in which Logo became changed in the course of entering the educational world, I demonstrate there how a dominant interpretation/ appropriation of Logo as a device for 'turtle graphics" dominated the educational world.

---

integrated or interlinked by a core set of organising principles that constructs power relations along particular lines (Omi & Winant, 1986:66). Unlike, however, those approaches to "discourse" which equate it with language and a purely textual form of analysis, and separate it from other social contexts and practices, I wish to employ here a poststructuralist view of discourse which is much more than an abstract politics of language games. Rather, this view focuses on the materiality of "discourse" in line with Bove (1990:57) who argues that 'discourse' makes possible disciplines and institutions which, in turn, sustain and distribute those discourses" (Bove, 1990:57). Discourses and their related disciplines and institutions are functions of power: they distribute the effects of power and, therefore, the study of "discourse", in describing the surface linkages between power, knowledge, institutions, intellectuals, the control of populations, and the modern state, as these intersect in the functions of systems of thought, leads inevitably to a study of institutions, disciplines, and intellectuals

In this sense, the claims for Logo -especially as presented by Seymour Papert's rhetoric in *Mindstorms*- were a non-neutral, socially organised set of ideas, they became a preferred Logo discourse.

4

3. Methodology. In terms of methodology, the research briefly reported here has been largely qualitative. At a first stage it involved analysis of a large body of primary and secondary literature. Secondly, the main body of the original data has been gathered through semi-structured interviews with the original developers of Logo (mainly academics based in the US) and other people who have been significantly involved in its evolution in both the US and the UK at different stages. These included Harold Abelson, Janet Ainley, John Berlow, Al Cuoco, Mike Doyle, Wallace Feurzeig, Paul Goldenberg, Ronnie Goldstein, Brian Harvey, Celia Hoyles, Uri Leron, Henry Lieberman, George Lukas, Seymour Papert, Dave Pratt, Mitchel Resnick, Sherry Turkle, Bill Tagg, Dan Watt, Molly Watt, Uri Wilensky and John Wood. Thirdly, the research has involved classroom observation, discussion with teachers, analysis of video-taped classroom activity with Logo and classroom talk about work with Logo.

As already said, an interdisciplinary "cultural studies" perspective first developed by Richard Johnson at the former Birmingham Centre for Contemporary Cultural Studies (CCCS, currently Department of Cultural Studies) has been adopted which overcomes certain limitations of earlier approaches to the sociology of technology addressing the four (analytically) different "moments" in the life-cycle of Logo in education as a cultural product: a) the moment of production; b) Logo as a "text"; c) the stage of "meanings" (consumption) and d) the stage of "lived cultures"[5]. Although the model divides analysis in four artificially distinct "moments", it should be clear to the reader that these spheres are not discrete, causally related or sequentially ordered; rather the model should be seen as a heuristic device. The cultural and political import of Logo is to be found in these multiple explorations taken together. And it is critical that they be, in fact, taken together. Although the four have been separated for greater discoursive clarity, all four are always present in any actual situation. They will arrive together in any real classroom, and their relative impact will depend on the specific circumstances.

Having outlined the research findings of the whole study, the rest of this paper will focus more closely on analysis of "moment 3". It will discuss how the "Logo movement" - while it initially sought to bring about fundamental and comprehensive change in American education, to reinvent teaching and learning and to provide intellectually challenging environments for a diverse population- it was quickly "institutionalised", "normalised" and assimilated into existing educational practices and any structures.

4. The Social Context of Use. Analysis of "moments" 1 and 2 explores how the social relations characterising the environment from which Logo emanated became embedded in the technology itself. Logo as a technical artefact emerged from its context of development more suited to some uses than others; technologies are never neutral. However, whatever these biases may be, their power to control what ultimately occurs is only partial:

> A technology's biases may establish a set of initial conditions favoring one or another outcome, but the drama of what actually does transpire cannot be foretold... What we find, perhaps not surprisingly, is that while the introduction of new technologies does create an altered situation in some ways, pre-existing power relations most often find a way to shape usage of the new technology so as to re-establish themselves, simply in a different form. (Bromley, 1995:ch.2)

---

[5] See Johnson,R., "What is Cultural Studies Anyway?", CCCS Stencilled Paper No 74, CCCS, University of Birmingham, 1983, and Johnson, R., "The Story So Sar: and Further Transformations?", in Punter, D. (ed), *Introduction to Contemporary Cultural Studies*, Longman, 1986.

The rest of the paper turns to look more closely into the interaction of Logo with its social context of use -that is with the power structures already in place where Logo was introduced. The discussion of the social and political context first will situate the introduction of Logo in its surrounding conditions. It will illustrate what emerges as a recurring theme in the empirical data, namely the uncomfortable relationship of the Logo discourse as a potentially "radical" and "emancipatory" pedagogic discourse to the "conservative restoration" which characterised the educational systems of both the US and the UK in the early 1980s.

5. Logo in US and British schools: an overview. In the early 1980s Logo was no longer a marginal, private experiment; through a small number of pioneering school-based projects it had caught the imagination of a large number of teachers. Following the introduction of microcomputers in education, it became available to a large number of American and British classrooms. A community of excited teachers emerged within which high expectations and enthusiasm arose about what was seen as the potential of Logo as a vehicle for educational change. The excitement was significantly greater in the US where, in many cases, Logo advocacy became synonymous with messianic zeal as many early Logo enthusiasts saw it as a panacea for the ills of an educational system in crisis. A large number of (mainly elementary) school teachers were said to have "caught the Turtle Fever". A 1982 American report reads:

> This report provides recent news from Logo projects and classes around the United States and Canada. Far from assessing the status of Logo in American and Canadian education, the report merely hopes to capture something of the character and spirit of the people who are teaching Logo or guiding logo projects. Logo projects and programs exist from coast to coast: from the Microcomputer Resource Centre at Teachers College at Columbia University in New York, to the Marin Computer Centre in Corte Madera, California. Telephone calls to participants in many Logo activities invariably found people enthusiastic about Logo and its future. It was seldom necessary to ask questions after saying something like, "Tell me what you are doing with Logo". Explanations and anecdotes came pouring out. (Lemmons, 1982:334).

The early Logo literature is replete with wildly unlikely and totally unsubstantiated claims about the educational value of Logo that seem to have been based primarily on blind faith rather than research evidence:

> It seems that Logo is not just the best educational software on the market at the moment (not, in itself particularly high praise), but a new type of educational resource with enormous potential for developing the social, emotional, and intellectual abilities of learners. (Higginson,1982:328)

After a while, however, the excitement started to wear off. The initial atmosphere of extremism gave way to a more cautious advocacy. Limitations and inappropriate uses were found while controversial research evidence was being cumulatively reported from experimental studies. The great expectations of professional people from Logo did not seem to be realised. Many of those who had believed the early extravagant claims about the radical potential of Logo felt disillusioned. Since the mid-1980s there has been an increasingly more pervasive backlash against Logo -especially evident in the States- where Logo has been in a sense denounced as having failed to deliver what it promised. There is an impression that Logo has run its course like a number of other educational innovations in the past.

6. Interpretations of the "pendulum swing". A number of positions have emerged in the literature as candidates in the quest to explain the pendulum swing against Logo in the 1980s (e.g. Clements, 1985; Michayluk, 1986; Maddux, 1992). Although each of these accounts has a contribution to make, this contribution is limited and partial as -with no exception- these accounts have assumed a functionalist orientation addressing practical problems of implementation as partial explanations. In so doing, I will argue, such accounts miss the wood for the tree and fail to shed light in deeper structural relations underpinning the introduction of Logo as an educational innovation. Although each interpretation alone certainly contains germs of truth, it is not enough to superficially describe what could easily be termed "the growth and decline of Logo" or -at best- interpret it in functionalist terms. A number of more elaborated and interrelated explanations emerges from part of the research data collected for the study that is being reported here. For instance, two of the leading figures of the MIT Logo group's educationalist strand suggest that the "decline" of Logo can be partly interpreted in economic terms:

> But the great push which I think was an economic push and a short of revivalist push, the real momentum in this thing was already gone. Computers were in the schools, computer companies had decided that Logo was not a programming language to use for selling more computers

A leading computer scientist within the Logo Group provides a different interpretation arguing that the second half of the 1980s was a time when lots of other things were being developed for computers whereas in the early 1980s Logo was one of the dominant uses of computers in schools:

> So if you look at the percentage of computer use at schools dedicated to Logo, that clearly dropped very rapidly in the 1980s. If you looked at the number of hours of Logo usage my sense is that it continued to grow but as a much smaller piece of the bigger pie. Because they were so many other things that were being done now with computers. So it was no longer a dominating influence. In the early 1980s Logo had always set the agenda for what people talked about both within educational circles and educational research circles, Logo really influenced what people were talking about. It became less of a central voice in those discussions as time wore on because there were many more voices that were introduced.

A synthesis of the previous two positions is provided by another key-figure throughout the development of Logo who argues that the recent rise of pre-packaged software of various kinds for schools is responsible for the pendulum swing against Logo:

> So the battle nowadays -it used to be which programming language are you using, should you program in Logo or BASIC or Pascal or C or whatever- nowadays the argument is 'should kids program at all?', we are back to that. Cause now you see 'there's all this wonderful software that you can use and why should anyone write their own?'... And not only is that argument with teachers, it is also with kids... Their standard of computer programs are computer games. So you start up Logo and here is the screen and nothing is happening. And nothing is going to happen until you do some work. And that's a hard sell these days.

A fourth interpretation is provided by Seymour Papert who sees the 'normalisation" of Logo mainly as a reaction of the organisational culture of schools:

> At the middle of the 1980s you saw a big change. Because in various ways the school administrations took over and sort of 'normalised' this. And I think it's like an immune reaction. In the period starting about mid-1980s until the early 1990s (although there were still a lot of visionary teachers) the dominant use of the computer was becoming this administration-controlled use, more to bolster the status-quo than to undermine it.

Although more useful than other explanations provided in the Logo literature, these original positions -even if taken together- still leave us with an unclear picture, let alone a critical sociological picture. The study reported here has been committed to providing a more sophisticated account of the mechanisms at play. Because the introduction of Logo in schools has been a more complex phenomenon than these partial accounts take it to be, in a sense that it has been located within a changing social, political and ideological context. To get the larger picture, therefore, it is necessary to address the introduction of Logo into schools as a series of conflicts and struggles over the meaning and control of education and the curriculum at least at three different -yet interrelated- levels: the political-ideological, the organizational/institutional and the pedagogical.

7. The social-political context. Logo was initially developed in years of immense support to maths and science teaching curricula in the US, in the late 1960s. The emphasis given to the teaching of science and mathematics in the immediate post-Sputnik years provided a conducive background for technological innovations that promised to make this teaching more efficient:

> The post-Sputnik crisis in the 1960s spawned the development of large-scale curriculum innovations and the advocacy of inquiry-oriented and student-centered instruction. It was a period of new math, radical revisions in chemistry and physics, open education, individualized instruction, and so forth.... Innovations, the more the better, became the mark of progress (Fullan, 1991:5)

Around the same time, in the late 1960s, American education seemed on the verge of a renaissance commensurate to the era of progressivism of the 1920s and 1930s:

> Practical innovations dotted the landscape; experimentalism from Montessori to free schools, often student controlled, succeeded in forcing a modicum of school reform in the public sector from the outside. At the beginning of the 1970s, education officials in cities and towns throughout the country had decided that it was necessary to create alternative elementary and secondary schools *within* the established order. The motivating power for starting these programs was by no means altruistic or a far-sightedness by educational professionals. They were simply persuaded, either by the example of successful projects outside the system or the eloquence of educational planners and critics, that certain problems of the schools could at least be ameliorated, if not solved by educational innovations. (Aronowitz & Giroux, 1993:55).

Building on the example of the community-controlled districts in New York elementary and junior high schools, big city Boards of Education moved into the new decade with plans to encourage neighbourhoods and educators to begin experiments in alternative high schools as well. The legitimacy of schools as educational institutions was challenged by low attendance and plummenting test scores (an all too familiar theme in the 1990s). Parents, especially those from minority communities and the remaining white middle class

in the cities, began demanding educational changes, the content of which remained unspecified. The ideas of Neil Postman, George Dennison, Jonathan Kozol, Charles Silberman and other "radical" writers were seriously considered in the quest for stability in schools. Thus a new progressivism came to accompany late 1960s and the beginning of the 1970s with a new literature on the death and rebirth of education bursting on the scene. Teachers who were sensitive to social and political injustices were able to supplement or undermine the biases and narrow world views that an increasingly standardised and instrumental curriculum offered. It was a curriculum attempting to maintain the existing knowledge and social order. Some teachers broke from the instrumental, non-political, non-intervention role of schools to use education for social change and enrichment. To supplement narrow or biased texts, teachers drew from instructional materials and used the civil rights movement, feminism, the anti-war movement, alternative school projects, media education, and other marginalised curricula to offer their students alternative perspectives and expanded world views. Similar to the social reconstructionists of the 1930s, who felt education could be the cornerstone of a new social order, were these nonconforming teachers who viewed the purpose of education in the 1960s not as training grounds for the needs of industry and a capitalist economic system, but for the needs of a democratic and just society.

In England, with favourable economic circumstances and a pervasive ideological presence, the preconditions for the flourishing of progressive education were complemented by the "licenced autonomy" (Dale 1979b) from political control which the education system enjoyed during the 1960s:

> ...the three major sets of condition necessary for the systematic implementation of progressive methods in State schools were present by the early 1960s -economic prosperity and an accompanying increase in resources for education; growing ideological acceptance in key areas and institutions (such as local inspectorate and training colleges); and an 'elective affinity' with the political grouping which dominated education (Dale, 1979a:194).

Progressivism had developed in the context of teacher autonomy and expanding resources. It was seen to provide spaces within which the actions of even small groups of teachers and pupils could assume significance out of proportion to their size and scope. Within this broader social and political context of education the historical conditions of possibility were created which can be held accountable for the appeal of Logo to many teachers in both the US and Britain: the introduction of Logo in the US and British education in the early 1980s was linked with the quest for an alternative paradigm in education which was already underway. The following quotations from the research data indicate something about the degree to which teachers in the US and Britain saw Logo not as a new movement itself but as an expression of already existing ideas connected to their social and political struggles:

> I 've been in other movements... I didn't see it as more special than what was happening in the "whole language" and other things that I had been part of before. What was happening in Logo seemed every bit as important and significant to me... So we saw Logo as one more of a very powerful handful of important endeavours happening in our lifetime and we threw our energy into it... The ideas weren't radical to me, I was already in those ideas. (a secondary maths teacher at that time, Boston, USA)

> I already shared the educational ideas underpinning *Mindstorms*, [it] didn't change the way I thought about education... It gave me a sense that there was a possibility to operationalise in education the ideas that I already agreed with... So what I found in *Mindstorms* was not a new educational philosophy; I found a way of putting into effect the educational philosophy I already believed in. (a secondary maths teacher at that time, England)

Logo was not an isolated computer programming language but carried with it a vision of social transformation closely connected to a particular "philosophy" for education. *Mindstorms* hosted a profound critique of (American) education, particularly in reaction to the technology and conformity of the 1950s. It argued that far from being an instrument of social progress, traditional perceptions of education were much more oriented to producing failure than to developing creative, critical minds that could be the basis for a more humanistic, democratic society. The existing educational system was seen as a conservative, reproductive institution that should be changed. Traditional school was seen as an improper learning environment which allowed only limited and conservative representations of knowledge. *Mindstorms* echoed Illich's de-schooling arguments which denounced large official structures and called for self-directed learning predicting the inevitable and imminent demise of public education in the face of the new consciousness spreading through society[6]. In a similar way, the Logo discourse -convincingly to some extent- maintained that to provide education that stimulates creativity, independent thinking, and humanism meant doing something different from what traditional schools were organised to do; therefore, it should be done outside the public educational system.

The critical progressivist, child-centred rhetoric of *Mindstorms* resonated with the ideology of a large number of teachers who were dissatisfied with existing school. A community of radical teachers started developing for whom Logo became a kind of symbol, a metaphor for using the computer to break out of the traditional ways of doing things in schools. In the context of disillusionment from the traditional educational system, high expectations arose from Logo (it is very difficult to avoid using technological determinist language) which was thought by many as providing -at the level of pedagogy- a liberating solution to the authoritarian conservatism of traditional classroom maths instruction:

> Papert's book *Mindstorms* (1980) was a breath of fresh air for those teachers who wanted to realise for their pupils all the promised benefits of the computer, but who rebelled at the simplistic "drill and practice" programs through which nirvana was supposed to be attained. The child-centred Piagetian pedagogy which seemed to be at the root of Papert's arguments chimed well with the way in which they had been educated as teachers, and with a still prevalent liberal-humanitarian concern for the personal development of the individual child. There was no expectation that here was a device for "jacking up" children's scores on conventional attainment criteria. At its peak, Logo combined a support environment not dissimilar to a charismatic religious movement, with a rationale which offered teachers a chance of actually putting child-centred approaches to learning into action. (Cooley, 1992:59)

---

6. Illich wrote: "The disestablishment of schools will inevitably happen -and it will happen surprisingly fast. It cannot be retarded very much longer and it is hardly necessary to promote it vigorously, for this is being done now. What is worthwhile is to try to orient it in a hopeful direction" (Illich, 1971)

Cynthia Solomon -an insider in Logo's development- writes:

> Papert's ideas in *Mindstorms* resonated with the philosophical stance of educators who believed in child-centred environments. For those who translated this approach to mean child-directed activities within the environment, Logo offered them a new opportunity to provide rich (especially mathematical) experiences. The mathematics reforms of the 1950s and 1960s introduced into schools in the 1970s fell short of the mark. Thus in many open-education classrooms Logo became another chance. For some mathematics educators (Leron, 1985; Hoyles, 1985), Logo offered a new way to teach the mathematics they have had limited success in teaching before.(Solomon, 1986:131)

At the same time -considering that from its initial development Logo had been offered explicitly as an alternative conceptual framework for the teaching of mathematics- the isolation of Logo developers from the mainstream (and largely conservative) mathematics education community, and their rhetoric of bypassing rather than reforming the existing math education, appealed to many maths teachers who were dissatisfied with the way of thinking which had earlier given rise to the New Mathematics. In this context, Papert's rhetoric in *Mindstorms* was largely responsible for raising enthusiasm among many teachers who wanted to see educational change. The introduction of Logo in schools was thus viewed by many "progressive" mathematics teachers as a radical departure from the dominant culture of mathematics education at the time.

Meanwhile, the introduction of microcomputers into schools in the early 1980s had excited the MIT Logo Group which now thought it was closer to seeing their vision put into action. To some extent -especially in the States- Logo became subsumed in the effort to appropriate microcomputers into educational settings[7]. As a programming language it was thought of as capable of bringing difficult ideas within the reach of young children. Within this context of the excitement created by the computer-literacy campaign, the rhetoric of *Mindstorms* contributed to a quick initial "success" of Logo. In addition to the affinity of Logo's radical educational discourse with the radical progressivism of a large number of teachers, Logo carried the exotic aura of high technology. At a time of euphoria for educational computing applications in general, so many other computer applications were very mundane and uninspired that Logo featured as more attractive. At a time that computers were rapidly being acquired by schools (but without good software or clear notions for defining their role and use) the availability of Logo filled an obvious need in the educational community: it offered a seemingly "powerful" way of using the machines, it lilled the desire for broad-ranging and highly desirable learning outcomes while it was -at the same time- accompanied by respect for the child's "natural" capacities and initiative. Papert's futuristic vision of children using and controlling computers resonated strongly with the excitement for the use and appropriation of computers created by the "computer literacy" campaign. Coupled with the desire to introduce computers to schools (largely driven by the computer industry as it argued in the analysis of "moment" 1), the eloquence of *Mindstorms* contributed to the excitement of many teachers who viewed Logo as their new opportunity for progressive educational reform.

At the producers' end finally, as the majority of people at the MIT Lab were coming out of the social movements of the late 1960s and 1970s, Logo became an anti-school symbol. It was considered to be the cleanest example of an anti-school use of the computer, of a use of

---

7. I will discuss later in this paper the implications of this inclusion of Logo as part of the "computer literacy" campaign. I will show how this appropriation effectively meant that a serious examination of the social visions built into -and in turn enacted by- Logo became very difficult, almost impossible.

the computer very different from anything that was happening in the school; it became the metaphor for the most subversive use of the computer. A member of the MIT Logo Group recalls:

> A lot of people around Seymour -including myself- were people who were always attracted to the various movements in turn, from marxism and Leninism to psychoanalysis and Artificial Intelligence. So I think the kind of energy and hope for some kind of radical transformation of society was embodied in the energy around Logo. It wasn't simply to make an incremental difference, it was to radically transform and to show that the current situation was essentially hopeless

In this sense Logo became a political project and a culture. To many teachers, Logo became the expression of an appropriate curriculum politics for the left which was offered as the articulation of a *counterhegemonic* discourse linked to a broad-based political movement for change (Laclau & Mouffe, 1985). However, the possibilities for such a radical utilisation of Logo in classrooms were never allowed to develop in mainstream schools as Logo was introduced into schools at the time that the social-political context outlined above had already started changing.

8. The conservative restoration and the pendulum swing against Logo.

The progressivist perspective in both the US and British education was strongly answered in the 1970s with the "back to basics" movement in which tighter regulation of the curriculum and the teaching process were imposed and legitimated under the call of national security and interest. In the 1980s US, as the American economy slipped within the global market place, questions concerning the quality of teachers and teacher education programmes further legitimated standardisation of the educational experience:

> The calls for the social reconstruction of the 1960s gave way to the needs of a middle class to hold on to what they already had. Education again had to answer the call of accountability, efficiency, and control for the purpose of a stronger economy and national interest on a global scale. The underlying interest was to maintain the status quo (Muffoletto, 1993:100)

From an American (US) perspective, Ira Shor (1986) situates this attack on education within an analysis of the period since the late 1960s in terms of a conservative restoration in American politics beginning with the watershed election of Richard Nixon in 1968. Thus, the fact that Logo was not available to American schools before the early 1980s meant that the changing political climate in American education undermined any potential of Logo-like ideas to assist "progressive" grassroots educational reform, even more so through its "utopian-deschooling" version. While the political climate of rebellion and reform that had marked the American 1960s was largely responsible for the impulse for change at the Logo's producers' end, as the decade wore on the rise of the new conservatism in educational policy reflected a pervasive retreat among progressive forces:

> Using the rhetoric of the civil rights movement's anti-elitism, educational conservatism took over in the mid-1970s leaving fervent ideologues of educational reform bewildered and ashamed. Administrators and teachers who had furiously tried to "retool" in the hectic sixties breathed a sigh of relief and set out to invent a new ideology of learning which stressed "standards (Aronowitz & Giroux, 1993:58)

Discussing the attack that the right in both England and the USA has launched on the work of schools and the practices of teaching and learning that take place in educational institutions, Avis (1991) writes from a British perspective:

> The concern with standards, both academic and attitudinal, is paramount. Schools, it is argued, have been lax, whilst child-centred curricula which work from children's interests are considered antithetical to a disciplined and serious engagement with knowledge. Thus there is a call for a return to basics. The attack from the right has keyed in with popular sentiments and paradoxically is supported and reinforced from the "left" (Avis, 1991:116)

The "attack" on progressivism coincided with the process towards the centralisation and standardisation of schooling. According to Gordon (1985), this was achieved

> ...largely through cuts, which eroded the basis of progressive education, with its dependence on diverse resources. With the simultaneous advent of monitoring teacher autonomy was narrowed... The flexibility and teacher control necessary in child-centred education were less and less possible (Gordon, 1985:121)

This effective counterattack by the conservatives at the ideological level accountable for the reversals that have marked the 1980s can also be held largely accountable for what is described in the literature as "the pendulum swing" against Logo. Within this adverse political climate of the 1980s which generally devalued and discouraged radical approaches to pedagogy, there has been an increasingly more pervasive backlash against Logo. The considerations concerning the construction of the possibilities of the attack on progressivism are familiar from the literature (CCCS, 1981; Education Group II, 1991; Dale, 1979a; Shor, 1986; Dadds, 1992) whereby explanations are provided of the complex conjuncture of the historical development of social relations which led to these possibilities in the first place. Having situated the introduction of Logo into mainstream schools at the macro-level within this context of conservative restorational politics of education, the question arises now of how Logo came to be appropriated within this adverse political climate.

9. The appropriation of Logo in schools during the conservative restoration and its interaction with the organisational context: an overview. The introduction of Logo into schools in 1980 was the beginning of a big deviation that went away from Logo's developers original intention of "educational megachange" (bypassing school) to the direction the educationalists' strand of the MIT's Logo Group had suggested. I quote Seymour Papert:

> It started a root that made it [Logo] a school thing whereas originally in my head it was an anti-school thing, it was **instead** of school (original emphasis)

Thus during the last fifteen years we witness a contradictory and rather problematic effort to capture and contain this somewhat utopian and romantic conception of *education* within the institution of *schooling*. Since the early days of Logo in both US and UK schools, serious questions existed about whether Papert's vision could ever be achieved in actual classroom settings. Many of the earliest classroom implementations seemed to trivialise the potential that Logo developers were seeing in it limiting students' activities to simple computer graphics and omitting much of "the power inherent in Logo as a problem-solving environment" (Watt & Watt, 1993:38). Noss (1993) argues that fifteen years after the publication of *Mindstorms* and the introduction of Logo into schools, the opposite of Papert's vision is taking place:

> Far from withering away, schools are called upon to play a greater and greater part in the education of young people. Far from being used as an instrument of intellectual liberation, computers are used -both inside and outside school- as a mechanism to increase the degree of social control exercised over children. And almost everywhere, Logo has become -in its school instantiation- a shadow of itself, a means to draw pictures, learn about angles, develop "problem solving skills. (Noss, 1993:2)

Within an adverse political climate of conservative restoration in the 1980s, the "Logo movement" has not had the success envisaged by its originators and it is today regarded by many as yet another unsuccessful attempt at radical educational innovation. The metaphor of "resistance" to Logo "as a foreign body" by existing school structures has been employed by Papert (1993) to account for what simplistic technological determinist accounts name the "failure of Logo to deliver what it promised". I will discuss this scenario of "resistance" to Logo through the analysis of its relationship to the organisational culture of schools.

10. The appropriation of Logo in US classrooms. The introduction of Logo in US schools has not had the character of an organised educational reform; it was a grass-roots innovation initiated by teachers at the level of educational practice. The overall goal was to stimulate a new way of working in the classroom which would give students a sense of purpose and foster their creativity and autonomy. Yet in the move into the classroom the vision presented in *Mindstorms* became transformed, in many cases to a degree that the outcome was in direct opposition to the original intentions; Logo was appropriated differently. In the US, Logo was introduced to schools largely as part of the "computer literacy" campaign of the early 1980s. The National Council of Teachers of Mathematics (NCTM), a large organisation which effectively made the policy for Mathematics, was a catalyst in this process. The fact that Logo was being introduced hastily as part of the "computer literacy" campaign resulted in its quick and shallow adoption at an introductory level. Although many teachers were very excited, few of them were familiar with the deeper ideas behind Logo; for the great majority of them Logo became simply a playful way to give the children the opportunity to control the computers.

The effort of the Logo group to develop books, materials and teacher training were attempts to develop elements of the infrastructure which was thought as necessary to sustain Logo as an innovation. However, only a small part -if at all- of the infrastructure required had been built prior to implementation. Excited by the fact that micros were being introduced into schools and seeing their vision coming closer to reality, the Logo Group didn't take into adequate account some of the realities of mainstream schools and particularly the mechanisms of institutional and organisational reaction that would resist an innovation like Logo which was incompatible with the dominant institutional structures and practices at a time of transition and conservative restoration. Logo was an innovation which contained the promise of disruption of school routine and of the normative function of schools. Considering that school itself has been developing as an institution in the West since the Enlightment largely based upon a number of institutional and organisational values like respect for hierarchy, competitive individualisation, a receptivity to being ranked and judged, and the division of knowledge into discreet units and categories susceptible to mastery (Dreeben, 1968), one can see that the introduction of Logo was felt as undesirably disruptive as it meant that the culture should change its values and habits in order to implement it. Thus the introduction of Logo was felt as a threat to existing school structures and this at a time that political/ideological priorities were displaying a determination to recapture the lost ground. In this sense, Logo (which was, after all, a set

of practices glued together by values) met tremendous resistance at both adoption and implementation and in most cases it was appropriated in conservative rather than radical ways. The following section provides examples.

11. Logo becomes part of the curriculum in the US. Partly due to the personal influence of members of the Logo group, some of the local school districts in the Boston area initially (Boston, Lexington and Brookline) and later throughout the country decided that Logo should be part of their curriculum, yet without any explicit educational rationale. "Learning Logo" was largely an end in itself and also a way to "computer literacy". Largely subsumed to the ideological "computer literacy" campaign in progress, the introduction of Logo here as part of the curriculum was used as a legitimation lending schools superficial glamour. In the hands of educational policy-makers Logo became part of a technocentric way of thinking about education in which -rather than starting with a determination of what they wanted schooling to accomplish and then examine how technology might be used to achieve those goals- computing initiatives were unfortunately based on the attitude "this technology exists, we 've got to have it".

Within this context, American teachers were required to teach Logo as a subject at a certain age or grade level and all students were required to learn it going through a series of activities. In 1984 and 1985 these kind of curricula were in place in many schools throughout the country and some of them still are. Very quickly Logo became *institutionalised* and teachers were expected to teach it as any other curriculum subject, as just another "thing" that students should learn. A secondary maths teacher in Boston recalls:

> So what happened was you would have a curriculum and if you were a grade 4 teacher you would get a package just like you would get for mathematics, or reading or whatever your students were expected to learn, and some activities. And once or twice a week you would take your class to a computer lab and go through the activities with them.

This view of Logo as a "school thing" and as part of the curriculum was a perversion of anything that the developers of Logo had imagined. Logo was being used as something that you had to learn, and many schools decided to teach it in a standard way. The fact that Logo quickly came to be seen as part of the curriculum meant that any potential of Logo as a radical educational innovation had been neutralised from its first steps.

From its inception Logo was an alternative approach to teaching and learning which required and encouraged very different kinds of activity in practice largely incompatible with the dominant conception of the curriculum as neatly fragmented. The kinds of activity that Logo called for were essentially project-based kinds of work which were cutting across the multiple division of the curriculum, the division of the day into periods, the division of knowledge into subjects, etc. Such an approach demanded the break of the ordinary structure of the curriculum and was therefore a threat to institutional change. Seymour Papert describes the tremendous resistance built up against Logo by conservative school structures adopting the metaphor of the human body:

> ...this very well structured organisation is not going to just let itself changed. Its reaction to something new is going to be severe... like the body defending itself against a virous or whatever that's come in

The resistance of traditional school structures in the 1980s was not only against Logo but also against any "radical" use of computers in education. Despite the existence of a large

number of visionary teachers, the administration-controlled use became the dominant use of the then newly introduced computer, which served more to bolster the status quo than to undermine it. While at the beginning teachers had enjoyed a relative autonomy in the use of computers which allowed them more creative and less-controlled work with Logo in their classrooms, it did not take long before the access to computers became centrally controlled by administrators, especially in secondary schools. Computers were kept in special rooms called "computer labs" away from the mainstream of learning, something which emphasised the dominant view of computers as a separate curriculum subject. Papert describes this process of "normalisation" using again the metaphor of the living organism:

> It's like an immune reaction. This foreign body came in [Logo] and -like any other living system- it finds ways of resisting, making antibodies or putting it into a little cyst. The cyst here was called "the computer lab.

A special curriculum for computers was developed and in most cases specialist teachers undertook to teach it. As part of the institutionalisation process, a *professionalisation* took place which is still on today in the US. A new profession emerged in education, that of people whose job was about computers and "teaching computers". Through the creation of the profession of the "computer teacher" and the "computer coordinator" and the "school computer expert", a whole culture was created which was rather conservative. The people who were attracted in that period were not very radical and the kind of knowledge they had -their model of what the computer and programming is about- was primitive; a rather conservative culture of "professionals" was established. The same thing happened to many uses of the computer other than Logo. A similar picture of professionalisation arose in Britain around the same time involving specialist advisory teachers (mainly for Mathematics and IT) who were appointed by Local Education Authorities and had a strong impact on what happened in the schools. A maths teacher in England remembers:

> So there were a lot of INSET attempts to get it off the ground, a lot of them badly done because a lot of them were done by people who themselves did not understand the significance of Logo and so the very people who did it were the people who were pushing the idea that it is used 'to teach angle on Wednesday the 15th of November' sort of thing. Or there were IT people who thought it was all about sort of teaching Logo in the way that people used to teach BASIC, so you go through the commands, you teach them the FORWARD command, then you teach them the RIGHT command, then you teach them the LEFT command, then REPEAT and so on...

As Logo came to be seen as just another curriculum subject in the US, students were also examined in Logo, an approach which was anathema to Papert's vision of Logo as a tool for exploration and thinking:

> The computers were put in a special room away from the mainstream of learning, there was a specialist teacher, a special curriculum even, and -most horrifying- across the river in Boston for the last ten years every elementary school child has to take a **test** in Logo! Like having a riding test before you are allowed to ride a bike. It is "first pass the riding test and then you may ride the bicycle". And then it turns out that there aren't any bicycles or that there are too few bicycles. If you pass the riding test you can ride the bicycle for five minutes a week

The case of Advanced Placement Exams (APE) is another example illustrating how Logo was caught up in the wheels of existing educational structures. The APE reinforced the construction of Logo as a "baby language" and its deeper institutionalisation as part of

the lower grades' curriculum. The APE were taken by High School students who had taken College equivalent courses in High School and wished to get College credit. Students with a sufficiently high score on APE were given college credit. The same applied to "computer literacy" courses involving programming languages as subjects. However, the standards developed for the APE were based on PASCAL which was the dominant programming language:

> In the United States, the Advanced Placement exam in computer science, leading to college credit, has had a beneficial effect on what language is used... The Advanced Placement exam requires a structured language, Pascal. Because over 95% of introductory university computer science courses are based on Pascal, it is not surprising that the Advanced Placement exam in computer science uses Pascal. (Bork, 1993:75)

At the practical level then, since PASCAL had consciously become the standard currency for getting College credit for High School work, Logo did not have the same exchange value for high-school students. Moreover, the decision to have PASCAL as the standard language for APE constructed a sense of superiority around it as it also made it look as a more advanced language. This pushed Logo down into the lower grades and made it seem not appropriate for higher grades.

12. The appropriation of Logo in UK schools. The recontextualisation of Logo in Britain provides a window in the processes of "normalisation" of Logo and its degeneration as an educational innovation. It also connects strongly with the discussion of the social processes of Logo's production (moment 1) by revealing another aspect of the influence of commercialisation on the development of Logo: it shows how economic forces and educational policy decisions attached to them shaped the development of Logo in the UK and largely determined the Logo product that came to be used in British classrooms as well as the way in which this product would be appropriated. Once again at this point we are reminded that the borders drawn among the four "moments" of analysis of Logo in this project have been artificial and purely analytic.

Logo appeared on the British scene in the early 1980s. Ronald Reagan's demand for educational quality in the USA was paralleled in Britain by Margaret Thatcher's call for a return to "Basics" and also by the Education Secretary's paper on "teaching quality". Within this context, a similar attitude in the educational policy of both the US and the UK demanded a rapid introduction of computers in education by funding national drives to place computers in schools. The UK Department of Industry (DoI) subsidised the introduction of "home-made" computers to both primary and secondary schools and a massive training campaign was launched to teach teachers the basic skills that were thought as needed for operating the micro in the classroom. British initiatives began in 1980 with the Department of Industry's Micros in Schools scheme, followed shortly by the Department of Education and Science's Microelectronics Education Programme (MEP), a government agency. In common with many countries at the time, the UK government saw their role as equipping schools with machines first, and only secondarily to aid in the process of deciding what to do with them. Under the Department of Industry (DoI) scheme, secondary schools were offered half the cost of one of two British micros, one of which did not actually exist at the time the scheme was announced. The scheme was later extended, in a slightly modified form but still with the patriotic clause, to primary schools, special education schools and teacher training colleges. These various schemes had cost the government about £30 million by the end of 1983. However, interests other than

straightforward educational determined the kind of hardware, software and overall character of the attempted innovation; research evidence strongly suggests that the impetus for putting micros in the schools came from industrialists and not from educationalists (an argument strongly supported by literature, too. See, for example, Self ,1987, Doyle,1993 and Hoyles & Noss, 1996). A maths teacher in England remembers:

> It was time when computers were first starting to come into schools and schools wanted to get hold of this new thing and... "there is this very good offer". But what was on offer was only British-made computers... The motivation was nothing to do with education, it was actually about supporting the British computer industry

Guided by the policy imperatives of centralising curriculum control and the rhetoric of high-technology business interests, the British Government was poised for a major intervention which was clearly intended to convey a number of symbolic messages: that the government was on top of things, that it was in control and that it was "out in front" of this important development. The initiative was also surrounded by a justifying rhetoric couched in terms of international competitiveness, the needs of business and, only lastly, the possibility of enriching students' lives. The process of mandating a standardised form of educational computer had to be carefully managed, in order to avoid the appearance that Local Education Authorities were actually being ordered to do something. The approach that was taken, in the end, was not to clearly enforce a particular computer configuration, but to "recommend" and to make the selected system so economically attractive as to rule out any other alternatives on a cost basis alone. At the hardware front then, this politically inspired and economically motivated hardware prescription effectively defined the computers that schools were allowed to buy. The possibilities and limitations of the hardware chosen, in turn, defined the sort of software that would become available to schools. As part of this process, the versions of Logo that would become available to British schools had to be compatible with the "recommended" hardware. However, while schools (especially primary schools) "chose" the BBC computer, there was no Logo implementation available for this computer at that time. The BBC microcomputer had BASIC as the standard language built-into it. As Acorn had invested heavily in its own "improved" variety of BASIC for the BBC computer, they had a very big vested interest in not having a version of Logo, because they wanted to sell BASIC as the most wonderful thing in the world. BASIC was already established as a programming language, it was much easier to sell a new version of BASIC than a completely new language.

The BBC BASIC was a structured BASIC which allowed you to do recursion at least in part. This meant that people could write turtle graphics programs (that did the turtle part of Logo but not the list-processing part) for use on the BBC computer and also on the Research Machines computer for which there also wasn't a Logo in the very early days. This meant that in order to do any Logo at all one had to write an emulation of Logo in BASIC. When Logo implementations for the BBC did become available later, technical constraints were a serious factor discouraging schools from buying some version of Logo for the BBC machine. In fact, the BBC machine had a very low memory capacity and it couldn't run Logo properly. To be able to do so an additional new kit had to be installed on the computer, a technical constraint which discouraged teachers as one maths teacher remembers:

> ... it had to have a new kit installed. So it was very tricky, you had to be really committed. If you wanted to buy Logo for ten machines you had to buy ten new chips and install them without bending the pins, that was a nightmare

In 1984, four implementations of Logo for the BBC computer became available. Out of these four, two Logo versions were competing effectively at the time: one written by Acorn themselves and one imported from France, Logotron Logo. The Acorn one required two holes (two chip sockets), the Logotron one required one socket at the back of the computer. Logotron Logo was eventually adopted as it required only one chip. Once again, the Logo version that came out on top did so not due to its educational merits but due to reasons having to do with the technological nature and limitations of the BBC computer:

> And in the BBC computer at that time there were two spare holes, you put a word-processing chip in one and you put Logo in the other. And if you needed to use two holes for your Logo you couldn't have a word-processing chip in. And so it's one out for that very simple reason that it only took one hole. It wasn't the best implementation... In effect this in a way determined the kind of Logo that came to be used in [British] classrooms. You had a spare hole, 'which one fitted in the spare hole? which one was fairly standard? why don't we go buy that one?

In the meantime, however, the delay in producing these versions of Logo for the BBC machines already bought by schools (the gap between 1982 and 1984) had some surprising effects, the legacy of which still exists today: several individuals, amateurs, saw a wonderful opportunity to make money and produced little graphics drawing packages (turtle drivers) usually written in BASIC (one of them was LOGOCHALLENGE, another called DART). All of these programs allowed the child to drive a turtle using FORWARD, RIGHT, etc., none of them had recursion, list processing, proper control structures, arithmetic operations or serious screen editors. Yet some happily packaged themselves with the title 'Logo'. These packages were offered at attractive prices and caused confusion among teachers:

> But these other ones were called 'Logo' and how do you know? If you are sitting in an infant school and somebody says 'would you like a copy of LogoChallenge?' and it's only & 3.50 and you also get a book on what to do with it... And even now there are people who don't understand...a lot of things like DART, of qualities lesser or greater than DART, were called 'Logo'. I guess that teachers ended up quite confused. There was no message that could be coming through from this.

In 1983 the British Logo Users Group (BLUG) referred a number of these products to the Trading Standards. Mike Doyle, the current chair of BLUG recalls:

> And we received a letter back from them saying that 'There seems to be a general acceptance within the trade that the use of turtle graphics is equivalent to Logo'

This meant that by 1993 -legally in the UK- Logo and turtle graphics were the same thing. From being a computer language of interest to education, Logo in the UK has become turtle graphics. In 1985 DART was being used quite a lot for turtle graphics. At the same time, while the chip required for the installation of Logo cost &75, DART was a freely copyable package available from local school computer centres free of charge:

> And the only bits that mathematics teachers were talking about teaching were turtle graphics... And therefore people tended to buy... -they didn't have to buy DART- they got hold of it and tried it- and then said 'this does what I want, why do I have to go and buy the real thing for & 75?'. Because when they bought the real thing they didn't use any of the characteristics that make Logo a particular computer language, they simply used it for turtle graphics.

It is instructive to note that in the manual accompanying DART, its developers at the Hertfordshire Advisory Unit had written that when Logo became available teachers should bury this software (DART) gratefully and buy the full version of Logo. But they didn't, a lot of them continued to use DART. Dr. Bill Tagg, then director of the Chiltern Project at the Herts Advisory Unit, remembers:

> And in fact when Logo became available on the micro we stopped selling DART. *And after a couple of years we actually started selling it again because there was a huge demand for it, people were very angry* (emphasis added).

According to Doyle (1993:22), the result was that DART -not Logo- was the formative experience for teachers in the UK -the philosophy without the language through which it was expressed. Consequently, argues Doyle, the notion of Computer Language degenerated to 'precise sequences of instructions', Logo became little more than "Turtle Talk". Beverly Anderson's evaluation report commissioned by the MEP supports Doyle's argument. Anderson's report *Learning with LOGO* (1986) on classroom experiences showed that programmable toys such as Milton Bradley's Big Trak were seen as "Turtles", that turtle graphics programs written in BASIC -such as DART- were not distinguished from Logo, and that Logo itself was viewed as difficult, expensive, and (possibly) not necessary for doing Logo. Anderson's report confirmed that, in one form or another, "Logo" had been rapidly taken up in the UK, yet in a manner that had become acceptable to teachers and to the system. Hoyles & Noss (1996) provide a double explanation of this arguing that two contradictory processes were at work. On the one hand, they argue, the introduction of cut down 'Logo' resonated with the child-centred approach which had come to characterise English primary schools in the nineteen seventies:

> ...teachers committed to that approach together with parents and head teachers could view "Turtling" as happily fitting into the wide variety of 'child-centred' activities which could be found in many primary classrooms (Hoyles & Noss, 1996, forthcoming).

On the other hand, the very success of Logo's assimilation led to its being viewed as an "activity" in its own right, not a way of introducing radical change but as a way of operationalising existing priorities by an "added on" school topic rather than one integrated into the educational setting. By being equated to turtle graphics and incorporated as a minor activity among many others Logo was fitted comfortably into existing school structures:

> So Logo became a way of ordering turtles around the screen. Turtle drivers such as DART shaped the attitudes of a generation of primary and secondary teachers, and at the same time, such programs were conjured into existence to express these attitudes and priorities. Drawing pictures with a turtle became a new curricular compartment. Logo became *marginalised* by its very incorporation -everything had changed but nothing had changed. (Hoyles & Noss, 1996, forthcoming).

13. Logo, curriculum and appropriation: institution-led barriers in the conservative restoration. At the organisational and pedagogical level, the introduction and appropriation of Logo in real classrooms should be situated in this context of transition from an era of "progressive" education (which allowed schools and teachers a degree of autonomy) to an era of control and accountability which stifled autonomy. Overwhelming research evidence emerging from discussions with teachers and advisory

teachers about their experiences with Logo over the last 15 years (in both the US and the UK) suggests that it was the changing political climate in education which -more than anything else- created the conditions for a backlash against Logo in the 1980s; the strategy being neutralising incorporation of Logo into an increasingly centrally controlled curriculum rather than upfront resistance or exclusion. In most classrooms Logo was assimilated into what was gradually becoming a more and more standardised and conservative pattern of educational practice.

While in the very early days teachers (especially elementary teachers) who were excited about the introduction of Logo in their classrooms were able to use it experimentally as an expression of their child-centredness sensitivities, as part of their curriculum development and curriculum integration efforts, or (some) as part of their action-research methodology for professional development, their degree of autonomy and flexibility was gradually limited in the 1980s. Logo, which was an approach to teaching and learning which encouraged child-centred, experimental and unstructured activity was against the dominant ideology of a formal curriculum and curriculum fragmentation (which was already the case in secondary schools) as the incarnation of the "Back to Basics" ideological campaign. Dr. Bill Tagg, formerly director of the MEP Centre and Advisory Unit for the Chiltern Region for a number of years, says:

> Things have changed since because primary schools, too, have a much more urgent curriculum to get through. That's one of the reasons why Logo hasn't survived. But at that stage [early 1980s] the big difference between primary and secondary schools was the fact that there was time and opportunity, freedom from constraint in primary schools. Primary schools in those times enjoyed a very high degree of freedom that they haven't achieved previously or since. Ten years previously they would be working towards the 11+ exams... ten years later they were (?) in the National Curriculum. But roundabout that time they enjoyed a tremendous amount of freedom.

This high degree of autonomy that primary teachers still enjoyed in the early 1980s was to be missed soon as a result of the political decision to tighten the control of education which were already underway. The approach to teaching and learning encouraged by the Logo "philosophy" was in severe incompatibility with the specified curriculum and detailed syllabus which schools increasingly had to follow in the 1980s. A leading figure in the evolution of the Logo discourse in England for a number of years says:

> Logo doesn't fit with the curriculum as it stands. If you have a curriculum that's very fragmented there is no nice place for it to fit... In the UK at that time it was a much more flexible curriculum particularly at the primary school, and those teachers could do more about what they wanted. US rather similarly I understand, but I suspect in Germany and in France it was much more laid down what you do and much more fragmented, so it's actually quite hard to introduce this. *And then why it's more laid down, probably it's a symptom of something else more fundamental* (emphasis added)

The why is not hard to detect in the following words of a London's secondary teacher which echo the flavour of the Black Papers which in the late 1970s provided a conservative political critique of progressivism and its methods and theories, cloaked in populist rhetoric of contrasting anarchy and realism; like then, Logo is linked to the growth of anarchy and a "realistic" approach to education is advocated, the National Curriculum:

> Logo, yes, did encourage you to do what you wanted to do... It was the final (?) of these people who wanted to do what they wanted to do. It was the last... when they tried to do what they wanted to do. You can't have a sensible educational system where everybody just does what they want to do.... Logo breeds anarchy... And no national government, whether you are left-wing, right-wing or whatever, can allow that to happen... they all wanted a National Curriculum.

Teachers were confused and constrained; a "progressivist" primary teacher says:

> And I had that sort of tension in my mind about what does one do about the fact that we have a defined syllabus so even if one values the approach that Ronnie was using could one actually afford to have that situation not being able to guarantee what it was that the children would actually work on?

School administrators, for their part, had few organisational incentives to invite the Logo "disruption" into schools. Not only would they be required to respond to teachers' demands for the time and resources needed to attain proficiency, they themselves would need to attain some minimum level of competence in order to retain authority over teachers. Since there is usually no way for the system to reward this kind of involved, responsible management, nor any way to penalise its absence, school authorities' most common route was to ignore or quell demands for the implementation of such potentially disruptive (Papert uses the word "subversive") processes. A leading figure of the MIT Logo Lab says:

> There was this teacher very excited about using this thing [Logo] in her classroom but the school principal wouldn't really let her. Now what were you going to do about this? You attempted to go and just tell the school principal how it's good for his school to let her do this. But really it's not good for his school at all. And you will eventually discover that it's too much of a subversive element. But you don't want to go and tell him that you 've got this teacher there who's very subversive and wants to find ways to get around the structure of the school by doing things that don't really fit in.

This suited the interests of the management of many schools whose job was made considerably simpler as teachers' situationally-reinforced lack of motivation inhibited their action as change agents. School administrators were relieved of the responsibility for developing the creative management skills that would be required for teachers to develop Logo-related classroom skills, especially now that the opposite trend was scathing in. The administrative priority and control over teachers (and students) was strengthened by the separation of Logo from the rest of the classroom practice to be taught as a separate subject in a separate room -the "computer lab". This was the administrative strategy for all uses of computers, especially in secondary schools. Kids were brought to a (generally) windowless room presided over by a man (usually the computer specialist of the school) with rarely any other function than administering the machines. There, children were left to work for 30 or 40 minutes on Logo activities that in most cases involved writing trivial turtle graphics programs. This behaviourist fantasy fitted neatly into the organisational model of schools. This way of using Logo as a separate curriculum component for trivial tasks complemented existing organisational and practice models, signalling at the same time modernity and standardisation. In this sense, Logo was used in ways quite opposite to the intentions of its original developers as normative, administrative and pedagogical technology of a conservative type:

> While the typical teacher in 1980 had this computer work in her classroom and was using it to cut across the division of the day into periods, the division of knowledge into subjects, to break off the ordinary structure, now there was this shift! The computers were put in a special room away from the mainstream of the learning, there was a specialist teacher, there was a special curriculum even, and -most horrifying- across the river in Boston for the last ten years every elementary school child has to take **a test** in Logo! Like taking a riding test before you are allowed to ride a bike. First it is pass the riding test and then you may ride the bike. And then it turns out that there aren't any bicycles or there are too few bicycles. If you pass the riding test you can ride the bike for five minutes a week. (S. Papert)

School's concern with standardisation under the pressure of "restructuring" was not compatible with the Logo "philosophy". Traditional schools are supposed to produce the same outputs year after year. For example, they are supposed to ensure that seventh graders will emerge at essentially the same age with essentially the same sets of skills and broad values this year as last If they do not, then important categories like "seventh grade" or even "common school" lose their meaning. Standardised or "teacher-proof" curricula, standardisation of facilities, of teacher certification requirements, etc., guarantee standardisation of "outcome". A former member of the MIT Logo Group and curriculum developer for many years illustrates how Logo did not fit well in this scenario of standardisation:

> It [Logo] included the philosophy of progressive education which said that students should be able to pursue their own interests... And that the way to foster good growth was not to track everybody into the same... Whereas in this country [US] we have schools -and a psychology- that tended to be built on a Henry Ford model of interchangeable parts... We are constantly having discussions about curriculum in a classroom -especially in Mathematics- where the discussions are based on 'what if the student moves from this class to that class? Don't they have to be doing the same things so that the kid will then fit in?' Or "what if he moves from this town to that town? we should have the co-ordinated everybody-in-the same...' You know, that kind of thinking. Or 'we have five tenth-grade classes; they are all going to go to eleventh-grade. Well, that eleventh-grade teacher... how will that teacher be able to teach them all if they haven't all learnt the same things?

Logo also collided with school administrators' preoccupation with examinations, results and academic "excellence". A senior teacher of Maths and Computer Science at a London's Grammar school says:

> We don't use Logo in our normal GCSE or A level teaching as such... If we were using a computer we would take twice as long to do whatever we wanted to do, the boys would fail their GCSEs, the school last year was 31st in the National League tables for academic excellence, if we drop below 32 we will not have any customers, I will be out of a job... Well, it comes down to it...

And he goes on to say:

> Yes, Logo has to do with progressive education. You can do what you want to do and the teachers became fascinated by Logo themselves and they tried to pass on that fascination to their pupils. I have always been restricted by the fact that this is an academic school and we have always had very good GCSE results.

> And after all this is what the parents pay for. We would like to educate them as well, obviously. But the bottom line is 'how many boys do you get to university'. We assume that all our pupils will go to university or some form of higher education. We are a Grammar school... we try to educate them but one has to... that's it... there are the pressures of the exams!... What it comes down to it, the boys at this school have to pass their CCSE and A level exams.

The managerial preoccupation with results and exams reflects the current tendency in education that any problem-solving activity which doesn't lead to a successful conclusion is a waste of time and should be avoided. As a result teachers do not have the opportunity to allow children to experiment in this kind of way because they are worried about how much "useful" material they have to go through. Two former mathematics teachers involved in curriculum development for years (the first in the USA, the second in England) point to this issue sharply:

> The fact that Logo faded away in the late 1980s goes back to what I was saying about the National Curriculum. And in fact now people expect the outcomes of the learning that's going on to be much more explicit. And people don't think so much about what the activities are that the students are involved in so much, they think more about the learning that the children have to achieve at the end of the day. And I think it's very very difficult to work in the sort of creative way that we are talking about with Logo if those are your aims.
>
> ...our entire educational system is too worried about being 'useful'. Certainly the current political climate is going to put a great deal of pressure on anything that doesn't have a quick pay-off and just get rid of it!

Also the mechanisms of assessment and accountability discourage teachers from taking risks using Logo as two teachers in England (one primary and one secondary) say:

> It certainly was a time when -in primary schools at least- teachers still felt that they had a lot of freedom to do what they wanted to do in their classrooms. And that sort of pressures we have now about assessment and accountability just didn't exist. And it's hard now to go back to what that was like...
>
> But teaching is really all about taking risks, it's about putting children into the driving seat, and that's a risk-taking business. But you don't get paid and you don't get promoted on the basis of taking risks, you get promoted on the basis of keeping your nose clean and doing what you are told to do. So teachers don't have the same autonomy and as a result...

Under the pressures of administrative resistance, Logo advocates had to change their style. The open confrontation with the school principals who were in most cases the gatekeepers of traditional structures was difficult as there was no illusion that the upfront advocacy of Logo as a subversive element to the existing structure was going to be resisted. In this process, the "revolutionary" language of the Logo group was gradually compromised:

> When computers got into schools we felt so excited about the possibility of seeing some of this somehow put into action that I think we got a little bit corrupted, we compromised with the system... you don't want to go and tell him [the principal] that you've got this teacher there who's very subversive and wants to find ways to get around the structure of the school by doing things that don't really fit in... But still you had to find a way. So you start adopting a language of 'I 've got something that's good for you....' (S. Papert) .

The change of language style gradually became a change of discourse. From being a "revolutionary vision" which was essentially an anti-school project, Logo advocacy started adopting a language of what could be acceptable to the established structure. The same happened with the whole computers in education movement in the 1980s which became a very conservative rather than a radical movement.

The inclusion of certain aspects of Logo in the first version of the National Curriculum for England and Wales in 1988 in a way which equated Logo to turtle graphics, was another step in institutionalisation. Hoyles & Noss (1996) argue that this inclusion intensified the process of Logo's marginalisation and assimilation as harmless into dominant structures:

> Logo has suffered the fate of incorporation into a canonical curriculum, a transformation in which what was to have been an instrument for exploration is ossified into an object of teaching (Hoyles & Noss, 1996, in press)

This inclusion added the gravestone on Logo's grave as Logo was socially constructed as something teachers had to do for three weeks and then move on. A former primary teacher remembers:

> But suddenly then there was a big sort of 'everybody has got to do Logo, it's in the National Curriculum' and there was a great sort of such a... people wanting courses on Logo and wanting to know about Logo, and in some ways that felt exciting and it felt good that Logo was being recognised in the NC, but actually in other ways the effect this had was that *teachers would do Logo for three weeks because the NC said they 'd got to do it and then they probably drop Logo when they didn't have to do it any more*. And actually I heard teachers saying to me that they would do it for three weeks and that would be enough. So it actually in some ways it had the opposite effect from encouraging it to be really integrated into school.

The words of another primary teacher illustrate vividly the devastation of teachers in the new order and partly explain why most teachers ended up assimilating Logo in their existing practice in a rather conservative way:

> So if you are a teacher with all the standard problems that teachers have and you ve got these issues about parents worrying about the progress of their children and you ve got a Head of Maths or a Head of the school who insists that you work in a systematic and organised way and they want evidence of children's progress at each stage and the assumption is that the kids do tests and exams and all these sort of things... With all of that stuff there you will only go on to take on board Logo to the extent that you can assimilate it into your current system.... What else could they [teachers] have done?

Within an adverse political climate which was reinforcing the inherent institutional conservatism of schools, Logo -in most cases- ended up appropriated in ways different from the expectations of its developers and from the "preferred reading" encoded in *Mindstorms*. In most elementary classrooms it was used simply as a way to teach children how to draw squares and triangles; its use was trivialised and its "radical" potential neutralised. The vast majority of teachers have tended to use Logo as part of a conservative educational practice assimilating it into their existing schemata of work:

> What people do is they try to put it into whatever system they 've got at the moment. So if there was something there that you had not seen before, you would evaluate it in terms of things that you currently understood.

At the level of pedagogy, Logo was a way of work which involved substantial laboratory-experimental kind of project-based work. In the early 1980s, the environment for such activity were no longer there as the priorities were shifting; mainstream schools -especially secondary- were no longer providing a felicitous environment for open-ended, creative experimental activity.

14. Possibilities. However, at a small fraction of schools where **there has been** a conducive environment, the story has been very different. There is a small number of Logo projects showing that a radical appropriation of Logo which would be largely in-line with the preferred meanings encoded in *Mindstorms* is not impossible. In a number of classrooms where the teachers' ideology was in congruence with the "philosophy" underlying Logo, the latter was used very much in the ways anticipated by its originators, in what were thought to be creative ways which were transforming the way students were learning and ways that were opening up new types of ideas to both students and teachers. For these teachers Logo became their way to restructure what education should be about. They viewed Logo as a way to change existing educational arrangements towards a direction of child-centredness, exploratory learning and open-ended projects. Logo work was used to cut across the division of the day into periods, the division of knowledge into subjects, to break off the ordinary structure of the curriculum. In some classes the innovative enthusiasm of teachers went beyond the expectations of Logo's developers; one of them says:

> In some classrooms there were phenomenal things that happened. Some teachers used it in ways that Steve and Seymour and I had never imagined. They pushed in interactions that we hadn't imagined and some of the things that we had dreamed about did come about.

The Lamplighter School Logo Project is an example of such an environment where Logo's appropriation was very in-line with the expectations of its developers. It was an ambitious project carried out at the Lamplighter School (a private school) in Dallas involving students aged 3 to 9. Conducted as a joint effort with the school, the MIT Logo Group and Texas Instruments (TI), the project was intended to provide the school with enough computer hardware that access to computers would not be a limitation on what the students could learn. Logo would be taught to all students and teachers, from nursery through grade four. Eventually, the project was expected to enhance learning in many areas as it facilitated the use of the computer as a multipurpose learning tool throughout the curriculum (Watt, 1982:117).

While the Brookline project was still running, Erik Jonsson --founder and President of Texas Instruments (TI) and ex-mayor of Dallas-- offered to fund and equip a Logo experiment in the Lamplighter School. Lamplighter was near TI's headquarters. Jonsson was Chairman of the Lamplighter board and a major benefactor of the school. Logo Computer Systems Incorporated (LCSI), a company set up by Papert and others to realise the commercial potential of Logo, created a version of Logo to fit the home computer then produced by Texas Instruments, the TI-99/4. By the spring of 1979, the Lamplighter staff were trained and fifty computers were ready for the school.

The Lamplighter School offered the MIT Logo group a chance to test Logo in a child-centred, yet untypical, setting. Lamplighter was an exclusive private school with four

hundred pupils and a pupil-teacher ratio of ten to one. The child-centred philosophy of the school was close to Papert's philosophy for education. Children here were allowed to follow their own direction and learn in purpose-built open-plan learning areas with no walls between the classrooms. Lamplighter (its name was derived from Aleksandrov's saying: "A child is not a vessel to be filled but a lamp to be lighted") provided the Logo Group with an ideal environment and a child-computer ratio of four to one. In this setting, the Logo experiment was seen as a huge success.

The Lamplighter project (similarly to a number of more recent projects in different countries) is an interesting case-study illustrating clearly the important role of the context of Logo's use in shaping the outcome. It also show the possibilities existing for a certain 'reading' (or mode of appropriation) to occur in such an environment which is more in-line with the original expectations and intentions of Logo's designers. What this example also show is that neither the preferred "readings" encoded in *Mindstorms* nor the context were absolutely determining. Such examples of "success stories" which mobilised Logo as a vehicle for educational change within specific locations which provided a fertile context, show the possibilities that within a suitable context radical ideas can be successfully utilised locally; Logo in these contexts has been appropriated to serve radical purposes. However, with the exception of similar isolated "success stories" at specific locations, these possibilities have hardly ever been present in the practice of the great majority of mainstream schools.

15. Conclusion. The main theme of this paper has been the role of the social context of use in shaping the ways in which Logo was appropriated. The predominant lesson that I have been drawing from this analysis of the social context of use is that when Logo was introduced, preexisting social relations were largely able to utilise the new technology as an avenue for reasserting themselves, thus reinforcing the status quo. Put into what were growingly conservative school settings, something that the "Logo community" had seen as quite unusual and "revolutionary" about the computer culture no longer was the main event. At the end of the day, in both UK and US primary schools, Logo ended up seen most often as an elementary geometrical program, or simply as an exercise in enjoyable computer interaction. In secondary schools, the situation was complicated by the tendency to ghettoise machines into laboratories where they were used for "computer studies", and if Logo was used at all, it was used in the context of "teaching programming" rather than as a means of expressing mathematical ideas. Logo was marginalised, remoulded as harmless to the educational organism, redrawn as "a programming language" or "a drawing tool" rather than as any kind of catalyst for rethinking the content of what is or what needs to be taught. The dominant and powerfully established school structures changed the meaning of Logo and assimilated it into the existing system, to the disappointment and bitterness of its original developers, and I quote one of them:

> Schools... just ate up Logo and spat it out as just another little school thing... they took the heart out of it... it became just as alienating and just as pointless as most other things in school.

From an Australian perspective, Bigum conveys the same message:

> Like a lunatic under a regiment of mind-altering drugs, Logo is rendered non-controversial or made non-problematic as it adapted or built into existing practices. It undergoes a translation, a reinterpretation so that it eventually becomes comfortable, a part of the curriculum furniture. Any potential Logo may have had for posing questions about current practice is blunted by its incorporation into existing practices and curriculum. (Bigum, 1986:195)

In some cases, however, the users of Logo ended up appropriating it for wholly unanticipated and potentialy subversive purposes. In conceptual and methodological terms, therefore, discussion in this paper has shown that -despite the determinism advocated by most technological determinist and social determinist approaches to educational technology- the impact of a given technology depends significantly on the context in which it is used, that the attributes built into the technology do not fully determine how it may be used and to whose benefit. It has been illustrated in this paper that neither the encoded "preferred meanings" nor the context have been absolutely determinant of the ways Logo was appropriated. This useful meso-position, is something that the cultural studies approach informing this study has allowed for.

After the discussion of the Lamplighter counter-example the question arose, of which way (and to what extent) the context of use shapes the use of Logo: do preexisting power relations in schools shape Logo use so as to reinforce those very inequalities, or is the user community able to appropriate Logo for transformative ends? My answer has been rather pessimistic. It seems that in essence, the possibilities for creative or open-ended uses of Logo are not frequently the case in contemporary schools. This conclusion bares a striking similarity with findings by Bromley (1995) whereby it is argued that:

> Although isolated "success" stories are sure to crop up even under current conditions, like weeds in the cracks of the status quo, enabling these growths to flourish into a thriving patchwork of alternative practices will require some fundamental changes in the technocratic regime that now governs what happens in schools. (Bromley,1995, ch 4:9)

I will leave the last word of this paper to an insider of the MIT Logo Group for a number of years, who summarises the influence of the social context of schools into which Logo was inserted in the early 1980s on the ways in which Logo was appropriated:

> I think Logo would have looked very different if it had been out there and developed at a point when a lot of progressive education ideas existed -like in the early 1960s- where there were new progressive schools in every place and everybody wanted to experiment with being a teacher...But it didn't really get out into the world until the early 1980s when we had a much more conservative, retrenched, back-to-basics kind of period. So in a certain way this radical technology was actually deployed at a very conservative moment in people's thinking about education, there is a kind of fundamental mismatch... At the time Logo came onto the scene there were also progressive schools but I think the attitude in general was a kind of 'back-to-basics'. *So I think that it [the introduction of Logo] really is a wonderful test-case for these notions about the interaction between the technical object and the surrounding culture... the surrounding culture won* (emphasis added)

****

References

Anderson, B., *Learning with Logo: some classroom experiences*, Loughborough, Techmedia, CET,1986.

Aronowitz, S. & Giroux, H., *Education Still Under Siege*, Bergin & Garvey, 2nd ed., 1993.

Avis, J., "The Strange Fate of Progressive Education", *in Education Limited: Schooling and Training and the New Right Since 1979*, Department of Cultural Studies, University of Birmingham, Unwin Hyman, 1991.

Beynon, J. & Mackay, H., "Information Technology into Education: towards a critical perspective", Journal of Education Policy, Vol. 4, No 3, 1989, pp. 245-257.

Bigum, C., "Some Critical Reflections" in Salvas, A.D. & Dowling, C. (eds), *Computers in Education: On the Crest of a Wave?*, Computer Education Group of Victoria, Balaclava, 1986.

C.Bigum & B.Green (eds), *Understanding the New Information Technologies in Education: A Resource for Teachers*, Centre for Studies in Information Technologies and Education, Deakin University, 1992.

Bork, A., "Technology in Education: An Historical Perspective", in R. Muffoletto & N. Nelson Knupfer (eds), *Computers in Education: Social, Political, and Historical Perspectives*, Hampton Press, NJ, 1993.

Bove, P., "Discourse", in Lentricchia, F. & McLaughlin, T. (eds), *Critical Terms for Literary Study*, Chicago and London, University of Chicago Press, 1990, pp. 50-65.

Bromley, H., "Culture, Power and Educational Computing" in C.Bigum & B.Green (eds), *Understanding the New Information Technologies in Education: A Resource for Teachers*, Centre for Studies in Information Technologies and Education, Deakin University, 1992.

Bromley, H., *Engendering Technology: the Social Practice of Educational Computing*, PhD Thesis, University of Wisconsin-Madison, 1995.

CCCS (Centre for Contemporary Cultural Studies), Education Group, *Unpopular Education: Schooling and Social Democracy in England Since 1944*, London, Hutchinson, 1981.

Cooley, M., "Human-Centred Education" in Bigum, C. & Green, B. (eds) *Understanding the New Information Technologies in Education: a resource for teachers*, Deakin University, 1992.

Dadds, M., "Monty Python and the Three Wise Men", *Cambridge Journal of Education*, Vol. 22, No 2, 1992, pp. 129-141.

Dale, R. (a), "From Endorsement to Disintegration: progressive education from the golden age to the green paper", *British Journal of Educational Studies*, Vol. xxvii, No 3, October 1979.

Dale, R. (b), "The Repoliticization of Deviance: reactions to William Tyndale" in L. Barton & R. Meighan (eds): *Schools, Pupils and Deviance*, Nafferton Books, Driffield, 1979.

Doyle, M., "Logo: Windmills, Writing, and Right Triangles", in P. Georgiadis, G. Gyftodimos, Y. Kotsanis & C. Kynigos (eds), *Logo-like Learning Environments: Reflections & Prospects*, Proceedings of the 4th European Logo Conference, Doukas School, Athens, Greece, August 1993.

Dreeben, R., *On What is Learned in School*, Reading, Mass., Addison-Wesley, 1968.

Education Group II, *Education Limited: Schooling and Training and the New Right Since 1979*, Department of Cultural Studies, University of Birmingham, Unwin Hyman, 1991.

Friedman, L.W., "From Babbage to Babel and Beyond: a Brief History of Programming Languages", *Computer Languages*, Vol. 17, No 1, 1992.

Fullan, M, *The New Meaning of Educational Change*, Falmer, 1991.

Gordon, T., *Progressivism and the Changing Educational Climate: a case study of a Community College in Leicestershire*, PhD thesis, Institute of Education University of London, 1985.

Higginson, W., "Leading fish to water: early observations on the use of Logo", *BYTE*, August, 1982.

Hodas, S., "Technology Refusal and the Organizational Culture of Schools", *Educational Policy Analysis Archives*, Vol. 1, No 10, September 14, 1993.

Hoyles, C. & Noss, R.L., 1996, in press.

Illich, I., *Deschooling Society*, New York, Harper & Row, 1971.

Johnson, R., "What is Cultural Studies Anyway?", Stencilled Occasional Paper No 74, Department of Cultural Studies, University of Birmingham, 1983.

Laclau & Muffe, *Hegemony and Socialist Strategy*, 1985

Lee, J.A.N., Guidelines for the Documentation of Segments of the History of Computing, *Annals of the History of Computing*, Vol.13, No 1, 1991, pp. 51-62.

Lemmons, P., "Logo update", *BYTE*, August 1982.

Maddux, C., "The Case for a Cautious Advocacy", 1992.

Michayluk, J. O., "Logo: more than a decade later", *British Journal of Educational Technology*, No 1, Vol. 17, January 1986.

Muffoletto, R., "The Expert Teaching Machine: Unpacking the Mask", in R. Muffoletto & N. Nelson Knupfer (eds), *Computers in Education: Social, Political, and Historical Perspectives*, Hampton Press, 1993.

Muffoletto, R. & Nelson Knupfer, N. (eds), *Computers in Education: Social, Political and Historical Perspectives*, Hampton Press, NJ, 1993.

Noble, D., *The Classroom Arsenal: Military Research, Information Technology and Public Education*, Falmer Press, 1991.

BEST COPY AVAILABLE

Noss, R.L., "The Politics of Logo", in P. Georgiadis, G. Gyftodimos, Y. Kotsanis & C. Kynigos (eds), *Logo-like Learning Environments: Reflections & Prospects*, Proceedings of the 4th European Logo Conference, Doukas School, Athens, Greece, August 1993.

Papert, S., *Mindstorms: Children, Computers and Powerful Ideas*, Harvester Press, 1980.

Papert, S., *The Children's Machine: Rethinking School in the Age of the Computer*, Harvester-Wheatsheaf, 1993.

Robins, K. & Webster, F., *The Technical Fix: Education, Computers and Industry*, Macmillan, 1989.

Self, J., "The institutionalisation of mediocrity and the influence of outsiders" in Scanlon, E. & O'Shea, T. (eds), *Educational Computing*, Open University, 1987, pp. 221-234.

Shor, I., *Culture Wars: school and society in the conservative restoration 1969-1984*, published 1986, The University of Chicago Press edition, 1992.

Solomon, C., *Computer Environments for Children: a reflection on theories of learning and education*, MIT Press, Cambridge, MA 1986.

Watt, M.L. & Watt, D.L., "Teacher Research, Action Research: the Logo Action Research Collaborative", *Educational Action Research*, Vol.1, No1, March 1993, pp. 35-62.

Wexelblat, R. (ed), *History of Programming Languages*, ACM Monograph Series, Academic Press, New York, 1981.

Acknowledgements. I am deeply grateful to my supervisors Prof. G.J.Whitty of the Policy Studies Group, Institute of Education, and Dr. R.L. Noss, Mathematical Sciences Group, Institute of Education, for their comments on an earlier draft of this paper.

I am also grateful to the Greek State Foundation of Scholarships (IKY) which has funded my studies.

For correspondense:
Angelos S. Agalianos
Policy Studies
Institute of Education
University of London
59 Gordon Square
London WC1H 0NT

Tel: 00322-2955116
Fax: 00322-2968602
Email: a.agalianos@dg22.cec.be